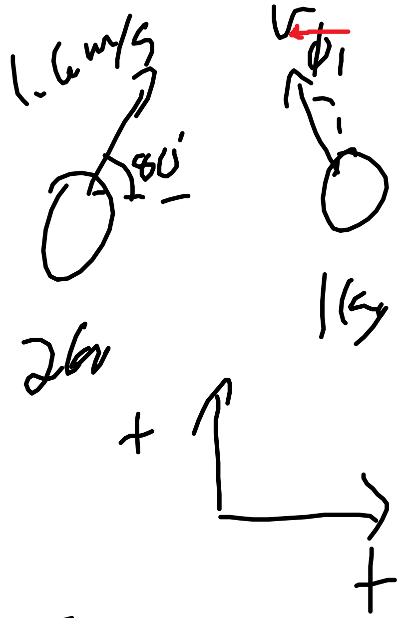
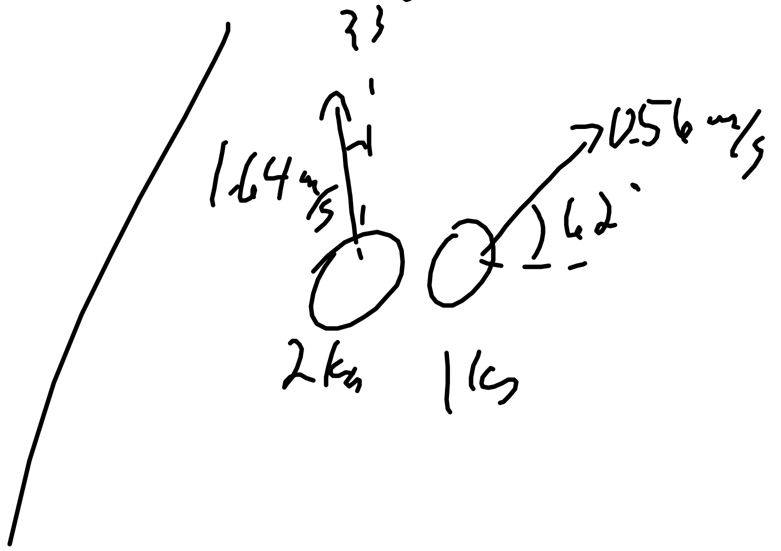
Q11 labbook





$$\sum P_{x_i} = \sum P_{x_f} \quad \sum P_{y_i} = \sum P_{y_f}$$

$$2kg(1.6m/s)\cos 80° + 1kg\, V_x = -2kg(1.64)\sin 33° + 1kg(0.56)\cos 62°$$

$$0.55567 + V_x = -0.18688 + 0.2798$$

$$V_x = -0.465$$

$$2kg(1.6m/s)\sin 80° + 1kg\, V_y = 2kg(1.64)\cos 33° + 1kg(0.56)\sin 62°$$

$$3.1514 + V_y = 3.27456 + .6526$$

$$V_y = 0.6494$$

$$V = \sqrt{V_x^2 + V_y^2} = \sqrt{0.465^2 + 0.649^2}$$

$V = 0.799 = \boxed{0.80 \text{ m/s}}$

$\phi = \tan^{-1} \frac{V_x}{V_y} = \frac{0.465}{0.645} = 35.8°$

$\boxed{36° \text{ W of N}}$

b) $\frac{1}{2}(2.0\text{kg})(1.6\text{m/s})^2 + \frac{1}{2}(1\text{kg})(0.799)^2$

0.596

$\stackrel{?}{=} \frac{1}{2}(2.0\text{kg})(1.64\text{m/s}) + \frac{1}{2}(1.1\text{kg})0.596^2$

$+ \boxed{E_{\text{lost}}}$

$2.56\text{J} + 0.3192\text{J} \stackrel{?}{=}$

$2.879\text{J} \stackrel{?}{=} 2.6896\text{J} + 0.3552$

$2.879\text{J} \stackrel{?}{=} 2.847\text{J}$

$2.9\text{J} \stackrel{?}{=} 2.9\text{J}$

elastic

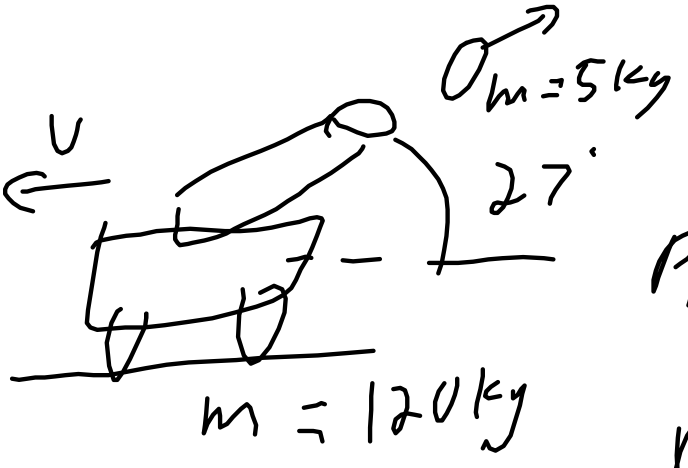
Quiz

v_i 50m/s

40m/s

V_1

$0_1 = 5\text{kg}$ $0 = 0.5$



$P_y = 0$ ← not going into ground

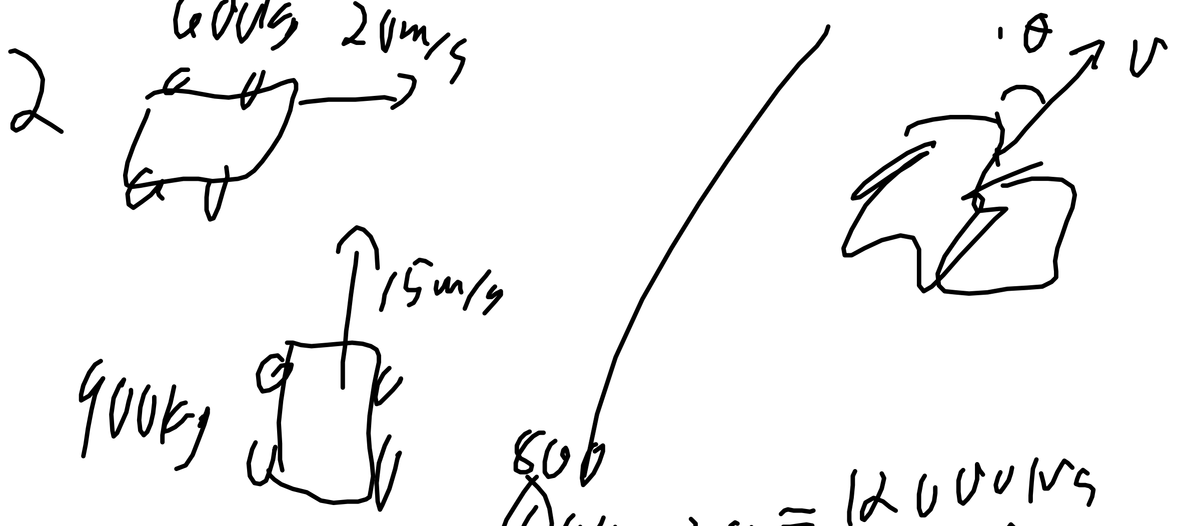
$P_i = 0 = P_f$

$P_{xc} = -P_{xb}$

$120\,kg\, v_{40ms} = -5\,kg\, v_1 \cos 27°_{50ms}$

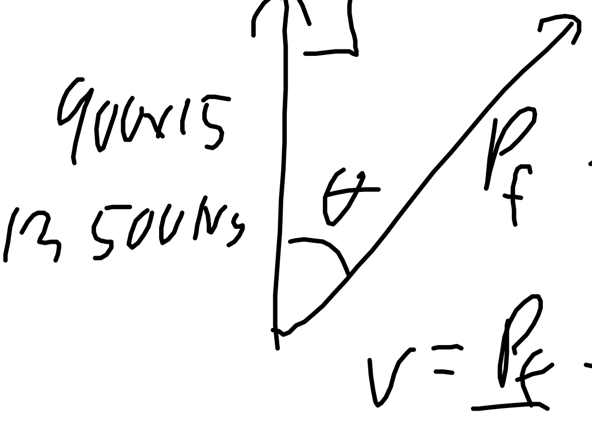
$V = 1.5\,m/s$ or $1.9\,m/s$

2



800

600 × 20 = 12000 Ns
16000



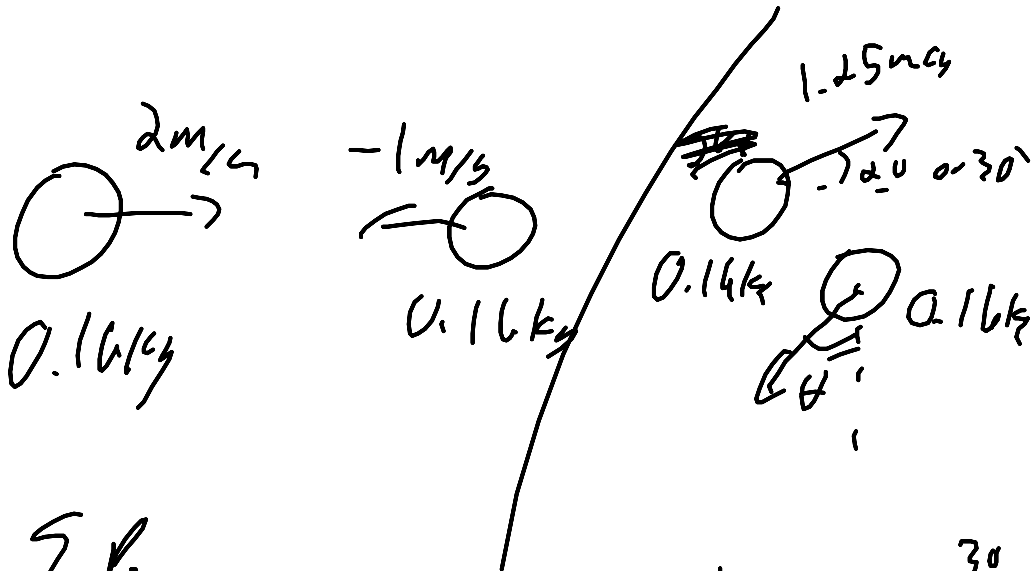
$P_f = \sqrt{13500^2 + 12000^2}$ (16000²)

$v = \frac{P_f}{M_t} = 12.3\,m/s$ or $12.0\,m/s$

$$\theta = \tan^{-1}\frac{P_x}{P_y} = 40.2° \text{ or } 41.6°$$

E of N

Q3



$$\sum P_{x_i} = \sum P_{x_f}$$

$$0.16kg(2m/s) - 0.16kg(1m/s) = 0.16(1.25m/s)\cos 20 + P_x$$

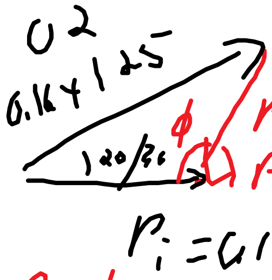
$$P_x = -0.0279\ kg\,m/s$$

$$0 = 0.16(1.25m/s)\sin 20° + P_y$$

$$P_y = -0.0684\ kg\,m/s$$

$$P_T = \sqrt{P_x^2 + P_y^2} = 0.07384$$

$v_f = \sqrt{v_x^2 + v_y^2}$ $= 0.07389$



$p^2 = 0.2^2 + 0.16^2 - 2(0.2)(0.16)\cos 30$ (20)

$p = 0.44$ (0.063)

$\frac{\sin\phi}{0.2} = \frac{\sin 30}{p}$ (20)

$v = \frac{p}{m} = \frac{0.07389}{0.16}$

$v = 0.46\ m/s$ or $0.63\ m/s$

$\theta = \tan^{-1}\frac{0.0279}{0.0684} = 22.2°$

or 8°

See diagram

~~22.0.~~ 67.8° from its original or 82° motion

b) $E_K = \frac{1}{2}(0.16kg)(2m/s)^2 + \frac{1}{2}(0.16kg)(-1m/s)^2$

$= \frac{1}{2}(0.16kg)(1.25m/s)^2 + \frac{1}{2}(0.16kg)0.46^2$ or 0.63^2

$+ E_{lost}$

$E_{lost} = 0.24J$ or $0.26J$

Test next class
Energy

W=change in energy = Fdcosθ = area under F-d graph
W_{net} = change in kinetic energy
$E_k=1/2\ mv^2$
$E_{elastic} = 1/2\ kx^2$ $k= |F_{elastic}/x|$
E_g= mgh if g is uniform
$E_g = -GMm/r$ relative to E_g=0 as r=infinity
W = change in E_g = -GMm (1/rf - 1/ri)
r is not equal to h
rf = r + h

Escape speed = |Eg | = E_k
Orbital speed $g=a_c = v^2/r = GM/r^2$

p=mv - vector diagrams
Impulse = change in p = F_{net} x t = area under the F_{net} -t graph
Momentum is conserved in collisions and explosions
Momentum and kinetic energy are conserved in elastic collisions

Orbital Quiz

1 a) $g = \frac{F_g}{m} = \frac{\frac{GMm}{r^2}}{m}$

$$g = \frac{GM}{r^2}$$ ← M Zorgon; r ← radius of Zorgon

$= 247\ N/kg$

b) $$g = \frac{4\pi^2 r}{T^2} = \frac{GM}{r^2}$$ M ← Zorgon; r ← distance to moon + r_Z

$$T^2 = \frac{4\pi^2 r^3}{GM}$$ M ← mass Zorgon

$T = 49000\ s$

c) $$E_g = -\frac{GMm}{r} = -1.11 \times 10^{11}\ J$$

d) $|E_g| = E_K$

$$\frac{GMm}{r} = \frac{1}{2}mv^2$$

$$v = \sqrt{\frac{2GM}{r}}$$ M ← mass Zorgon; r ← radius

$v = 4.7 \times 10^4\ m/s$

$\boxed{v = 4.7\times10^4 \text{ m/s}}$ v r ← radius 20-gon

e) $-GMm\left(\frac{1}{r_f} - \frac{1}{r_i}\right)$

$r_f = r + h$

$\Delta E_g = \boxed{2.0\times10^{11}\text{ J}}$

f) answer to e -3.0×10^{11} J

$\boxed{1.0\times10^{11}\text{ J}}$

g) $g = a_c$

$\frac{GM}{r^2} = \frac{v^2}{r}$ $v = 30\,000 \text{ m/s}$

h) $E_T = E_g + E_k$

$E_T = \frac{1}{2}E_g = \boxed{-4.5\times10^{11}\text{ J}}$